SOME BEES FROM SANDAKAN, BORNEO

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Borneo undoubtedly possesses a very large bee fauna, as yet imperfectly known. Collections from different widely separated localities furnish different species; and, while it is not yet possible to reach definite conclusions, there are some indications that there may be greater specific diversity in different parts of Borneo than in the Philippines, in spite of the fact that the latter area is divided into many islands. Sandakan, in North Borneo, is only about 250 miles from Mindanao; but its fauna appears to be very different in many respects from that of the Philippines. Especially striking is the great abundance and variety of *Trigona*, a genus represented by few species in the Philippines and, so far as we yet know, not present on Mindanao at all. Another remarkable fact is the presence of the genus *Heterapis* at Sandakan, a genus of minute and very peculiar bees, previously known only from three Australian species.

All the Sandakan material was received from Prof. C. F. Baker.

Genus **NOMIA** Latreille

Nomia strigata (Fabricius).

The specimens from Sandakan appear to represent a single species, but the variations are very striking, as follows:

Variety *a*. Abdominal bands bright emerald green suffused or shot with brilliant violet. Female, *Baker 9614;* male, *Baker 9613.*

Variety *b*. Larger than *a;* fourth band as in *a*, the others yellower green, without violet. Female.

Variety *c*. All the bands bright yellowish green suffused with pale vermilion. Male. This is variety *ridleyi* (Cockerell), already known from Singapore, Java, and the Philippines.

Nomia iridescens Smith.

One female of variety *rhodochlora* Cockerell, described from Mindanao and Negros. The first two abdominal segments entirely lack the metallic color seen in a specimen of *N. iridescens* from F. Smith's collection.

Nomia tuberculifrons sp. nov.

Female.—Length, a little over 10 millimeters; black, with four rather broad, very bright, emerald green bands (slightly tinged with red) on abdomen; legs ferruginous, with pale fulvous hair; wings dilute reddish fuliginous, the second submarginal cell large and square; supraclypeal area with a strong elevation or tubercle, representing the lower end of the frontal keel; clypeus shining, sparsely and not strongly punctured, reddish apically, depressed in middle, wholly without a keel, but with a low elevation or boss on each side; head and thorax with pale fulvous hair; mesothorax and scutellum with thin inconspicuous hair; mesothorax dullish and practically impunctate, except the disc posteriorly, which is shining and evidently punctured; scutellum slightly bigibbous, the bosses shining; postscutellum unarmed; tegulæ fulvous. Antennæ strongly reddened on underside. Hair of abdomen above, except basally, black, but on underside pale fulvous.

BORNEO, Sandakan, 2 females. This belongs to a little group of species which includes *N. elegans* Smith, *N. borneana* Cameron, and *N. erythropoda* Cameron. *Nomia elegans* differs by the hyaline wings and blue-green abdominal bands. (A specimen from Celebes, standing in the British Museum as *N. elegans*, differs from Smith's description, having the abdominal bands yellow-green shot with vermilion.) *Nomia borneana*, based on a female collected by Shelford, differs by the hyaline wings with pale nervures, but agrees in the tubercle on face. Cameron says that *borneana* is close to *elegans*, which may be known from it by the clypeus being coarsely punctured, subtuberculate on each side, and with a central longitudinal depression. Our insect has the clypeus as here described for *elegans*, except that it is sparsely and not very coarsely punctured. *Nomia erythropoda*, based on a male from Kinghang, has no bright-colored band on first abdominal segment; the wings are hyaline, with the radial and cubital cells smoky; the lower part of front and face are keeled in the center. According to Meade-Waldo, *erythropoda* and *borneana* are the same species.

The following key will be useful for the separation of the Bornean species of *Nomia:*

Wings dark violaceous; female, 12 millimeters long (Kuching).
violaceipennis Cameron.

Wings hyaline or smoky (fusco-violaceous at apex in *robusta*) ..... 1.

1. Abdomen clavate; legs rufotestaceous; male (Sarawak).
ceratina (Smith).

Abdomen not clavate ..... 2.

2. Large species (14 millimeters long); apices of abdominal segments with fulvous hair bands; female ..... robusta Cameron.

Smaller, 11 millimeters or less ..... 3.

3. Yellow-orange, with black or blackish marks, abdomen with eight dark spots; wings clear, slightly dusky, nervures yellow; scutellum bigibbous; male, 8 millimeters long (Liangtelan) ..... gribodoi Vachal.

Abdominal segments with pubescent bands; female, 7 millimeters long (Bidi) ..... bidiensis Cameron.

(*N. bicarmata* Cameron, misprint for *bicarinata*, was based on specimens from Kuching. Meade-Waldo states that a specimen labeled *bicarinata* by Cameron is identical with *bidiensis*. According to the descriptions, the stigma is pale testaceous in *bidiensis*, fuscous in "*bicarmata*.")

Abdomen with three cream-white bands; much of the abdomen red; female, 8 millimeters (Bidi, Sarawak) ..... leucozonata Cameron.

Abdomen with blue or green bands ..... 4.

4. Legs fulvous ..... 5.

Legs black ..... 6.

5. Wings hyaline; female, 11 millimeters; male, 9 to 10 millimeters.
borneana Cameron (erythropoda Cameron).

Wings reddish fuliginous ..... tuberculifrons Cockerell.

6. Thorax densely covered with fulvous pubescence; male, 11 millimeters.
varibalteata Cameron.

Thorax not thus covered with fulvous hair; clypeus keeled ..... 7.

7. First abdominal segment with a blue or green band.
strigata (Fabricius).

First segment without such a band ..... iridescens Smith, var. rhodochlora Cockerell.

Genus APIS Linnæus

Apis indica sinensis (Smith).

The single worker before me agrees best with the Chinese subspecies, *sinensis*. It differs a little in wholly lacking bands of gray tomentum at bases of abdominal segments 3 to 5 and in the clear yellow scutellum. The dark hair on the front is very long and abundant. Possibly a Bornean race may be recognized when we have more material.

Apis florea Fabricius and *A. dorsata* Fabricius were also found at Sandakan.

Genus NOMADA Scopoli

Nomada sandacana sp. nov.

Male.—Length, about 5 millimeters; bright ferruginous, with the region of the ocelli and two large triangular marks on first

abdominal segment black; head broad, eyes green; mandibles simple; antennæ very long; scape long and swollen, bright red; flagellum black, obscurely reddish beneath; third antennal joint long, equal to fourth; mesothorax dull; scutellum presenting two large brighter red spots, close together; base of metathorax largely shining; tegulæ red; wings dusky on apical margin; stigma and nervures dark brown; basal nervure going basad of transverse median; three submarginal cells, second receiving recurrent nervure in middle; abdomen broad, shining, apical plate deeply notched; legs red, the hind femora with a dark mark above near end.

BORNEO, Sandakan. Nearest to *N. testaceobalteata* Cameron from Kuching, Borneo, but easily known by the almost entirely red color, like that of a female. It is very distinct from all the Philippine species.

Genus **MEGACHILE** Latreille

Megachile tarsatula Cockerell.

A female from Sandakan (*Baker 9969*) does not differ from those collected in the Philippines (Mindanao, Palawan, and Negros).

Genus **PROSOPIS** Fabricius

Prosopis opacissima Cockerell.

Male.—Length, about or nearly 5 millimeters; not very robust; black, with the following parts lemon yellow: Clypeus, cuneiform lateral face marks (filling space between clypeus and eye, and ending broadly but obliquely above at antennæ), labrum except margin, greater part of mandibles, interrupted band on prothorax (not nearly reaching tubercles), tubercles, spot on tegulæ, anterior tibiæ except a large spot behind, basal half of middle and hind tibiæ, and all the tarsi (small joints rufescent). Eyes strongly converging below, so that lower part of face is narrowed; antennæ long, scape with a yellowish stripe, flagellum dusky ferruginous beneath; front densely and minutely punctured; mesothorax dull and densely punctured; scutellum with larger less-crowded punctures; area of metathorax with transverse sulci, the whole effect resembling the picture of a bird in flight; wings dusky, stigma and nervures dark, first recurrent nervures meeting first transversocubital; abdomen shining on first two segments, with excessively fine punctures,

third and following segments dull; sides of first segment with small fringes of white hair (*Baker 9985*).

Female.—Like the male, but face marks reduced to three; namely, a very broad band on clypeus (sometimes rounded, sometimes slightly emarginate, above), and lateral face marks; the latter keeping the cuneiform shape, but separated from the clypeal mark, and their lower ends scarcely going down as far as middle of clypeal band (*Baker 9987*).

BORNEO, Sandakan; 1 male, 4 females. The male is extremely close to *P. taclobana* Cockerell, from Leyte; but the mesothorax is more coarsely sculptured, the wings are browner, and there is less yellow on the scape. I cannot separate the female from the Philippine *P. opacissima*, which has hitherto been known only in that sex.

Prosopis borneensis sp. nov.

Female.—Length, about 6 millimeters, robust; black, with yellow markings as follows: Large cuneiform mark on clypeus (the point upward), broad-triangular lateral face marks (filling space between clypeus and eye, and ending on the orbits at an angle of about 45 degrees, a little above level of antennæ), interrupted band on prothorax (not nearly reaching tubercles), tubercles, large spot on tegulæ (which are piceous posteriorly), and all the tibiæ at base (the anterior and posterior ones broadly, the middle slightly). Tarsi black; mandibles with a subapical spot; antennæ black, flagellum ferruginous beneath apically. Face broad; front dull; mesothorax distinctly and very densely punctured, posterior middle more shining and not so closely punctured; scutellum shining, and with large punctures; base of metathorax with rugæ forming an irregular reticulation; sides of metathorax pruinose with fine pale pubescence; wings hyaline, slightly dusky, stigma and nervures black; first recurrent nervure meeting first transversocubital; second submarginal cell broad; abdomen shining, hind margins of segments laterally with fine pruinose pubescence. The apical ventral segment is sheathlike, inclosing the sting.

BORNEO, Sandakan. Related to *P. mindanensis* Cockerell, from Mindanao. Only the male of *mindanensis* is known, but the Bornean insect has the wings distinctly brownish, and the scutellum and posterior part of mesothorax less densely punctured, so I think it is certainly distinct. The lateral face marks of *mindanensis* have the upward extension linear instead of broadly angular.

Proposis hewittii Cameron, from Borneo, is an *Allodape*.

Genus **ALLODAPE** Lepeletier

Allodape hewittii (Cameron) var. **sandacanensis** var. nov.

Meade-Waldo considered the *Prosopis hewittii* Cameron, from Kuching, to be *Allodape marginata* Smith. It differs, however, in being much smaller, and having the face mark (female) as in *A. sauteriella* Cockerell, from Formosa. The present insect agrees with Cameron's description, except that the face mark and tubercles are ivory color instead of lemon yellow, the light band on prothoracic margin consists only of white pubescence, and the palpi are not black. The thin hair on abdomen above is not all blackish. Part of the difference may be due to error in Cameron's description, but we seem to have at least a distinct variety (*Baker 9979*).

Allodape marginata Smith.

One female, with more glistening pale hair on the last three abdominal segments than in the Luzon form.

Allodape cupulifera Vachal.

Six females; a variable lot, but apparently all one species (*Baker 9978, 9980*).

Genus **HERIADES** Spinola

Heriades bakeri sp. nov.

Female.—Length, 6 millimeters; black, of the usual form; clypeus simple; mandibles with two large teeth, and the inner corner approximately rectangular; a broad band of dense white hair along each inner orbit; antennæ black; tubercles densely fringed with pure white hair; tegulæ black; wings conspicuously dusky; first three abdominal segments with narrow but conspicuous white hair bands; ventral scopa white.

BORNEO, Sandakan (*Baker 9971*). Very much like *H. sauteri philippinensis* Friese, from the Philippine Islands (Luzon), but easily known by the smaller punctures of mesothorax. In typical *H. sauteri* from Formosa these punctures are about 50 microns wide; in *philippinensis*, about 35; in *bakeri*, 24 to 30. In the new species *bakeri* the wings are conspicuously darker than in the variety *philippinensis*.

Heriades fulvescens sp. nov.

Male.—Length, about 4.2 millimeters; black, of the usual form. I at first took it for granted that this was the male of

bakeri, but this cannot be, as the mesothorax has large punctures like those of *H. sauteri,* the wings are clear, and the hair at sides of face, on scutellum, etc., is pale fulvous. The antennæ are slender, but not so long as in *H. othonis* Friese, from Java. The upper part of truncation of mesothorax is polished and brilliantly shining.

BORNEO, Sandakan (*Baker 9972*). The second submarginal cell is shorter than in the European *H. truncarum* (Linn.), and the second recurrent nervure joins it very near the end.

Genus CERATINA Latreille

Ceratina collusor Cockerell, variety *a.*

Male.—Nearly agrees with type from Singapore, differing in that the scape has only one yellow spot (the lower one), and there are some punctures between the parapsidal grooves and the lateral yellow lines on mesothorax. Those may represent mere individual variation.

Female.—Like *C. philippinensis nigrolateralis* Cockerell, from Palawan, but differing thus: Labrum with a yellow spot; upper part of clypeal mark much larger and broader, emarginate at upper end; second submarginal cell smaller; first abdominal segment with a broad yellow hind margin, on which are two black spots; band on second segment entire, on third narrowly interrupted. There is no yellow spot behind the tubercles. The bands at sides of face are long. The hind tibiæ are yellow at base, and have a small sharp spine on outer side near end of first third. There is a similar spine in *nigrolateralis.*

BORNEO, Sandakan (*Baker 9973*). *Ceratina collusor* was described from the male, *nigrolateralis* from the female, but they are evidently very closely allied. The Bornean insect is *collusor;* perhaps a slightly modified race.

Ceratina flavonitens sp. nov.

Male.—Length, about 5.5 millimeters; shining, black, with the following parts bright chrome yellow: Labrum, mandibles, broad band behind whole length of eyes, clypeus except narrow band on each side, subtriangular supraclypeal mark, spots on front, inner orbits to vertex (the upper half of the band slender), prothorax with tubercles, mesopleura (black in front), metathorax (basal middle black), four stripes on mesothorax, scutellum, postscutellum, legs except hind tibiæ (which are black, with base and apex yellow), first abdominal segment except two very large black marks, bands on segments 2 to 6, and

entire middle of sixth. Venter yellowish except apically. Face narrow, polished; flagellum dark, only moderately long; mesothorax smooth and polished, punctured anteriorly; tegulæ rufotestaceous; wings strongly reddened; stigma long, piceous; apical plate of abdomen fulvous-margined, broadly rounded, obtusely subangulate at sides, faintly subangulate in middle, but wholly without a salient point.

BORNEO, Sandakan. Readily known from *C. flavopicta* Smith, from Sarawak, by the smaller size and yellow pleura. It is perhaps nearest to the much larger *C. ridleyi* Cockerell, but differs in a number of characters.

BEES PREVIOUSLY RECORDED FROM SANDAKAN

BAKER COLLECTION

Xylocopa collaris Lepeletier.
Megachile facetula Cockerell.*
Megachile sandacana Cockerell.*
Megachile atrata fulvipennis (Smith).
Dianthidium meliponiforme Cockerell.
Anthophora borneensis (Cockerell).
Anthophora zonata andrewsi (Cockerell.)
Crocisa angulifera Cockerell.*
Crocisa crucifera Cockerell.
Ceratina sexmaculata Smith.
Heterapis sandacanensis Cockerell.*
Trigona melanotricha Cockerell.*
Trigona rufibasalis Cockerell.*
Trigona melina Gribodo.
Trigona apicalis Smith.
Trigona ambusta Cockerell.
Trigona busara Cockerell.
Trigona melanocephala Gribodo.
Trigona geissleri Friese (var. *a*).
Trigona sandacana Cockerell.*
Trigona hæmatoptera Cockerell.*
Trigona breviceps Cockerell.*
Trigona trochanterica Cockerell.*
Trigona fuscibasis Cockerell.*
Trigona scintillans Cockerell.*
Apis florea andraeiformis (Smith).

Sandakan is the type locality of those marked with an asterisk. The Sandakan bees seen by me include fourteen genera and forty-two species. One of the genera (*Heterapis*) has not been found in the Philippines. Of the species, only twelve are also known from the Philippines, and in two of these the Sandakan insect is a distinct variety. The species described as new from Sandakan number nineteen.

Hewitt sent Cameron many bees from Sarawak. None of the new species described by Cameron are in the Sandakan collection, except *Allodape hewittii*, which is represented by an apparently distinct variety.

One would expect to find resemblance between the Sandakan fauna and that of Palawan. The bees known from Palawan are the following; those marked with an asterisk are not known from any other island:

BEES RECORDED FROM PALAWAN

Prosopis palavanica Cockerell.*
Halictus philippinensis Ashmead.
Halictus caroli Cockerell.*
Nomioides valdezi Cockerell.
Nomia quadrifasciata notha (Cockerell).
Nomia strigata (Fabricius).
Nomia lusoria Cockerell.*
Nomia elongatula Cockerell.
Nomia palavanica Cockerell.*
Nomada palavanica Cockerell.*
Dianthidium minutissimum (Bingham).
Megachile tarsatula Cockerell.
Megachile philippinensis Friese.
Ceratina philippinensis Ashmead.
Ceratina philippinensis nigrolateralis Cockerell.*
Ceratina humilior (Cockerell).*
Ceratina fuliginosa Cockerell.*
Xylocopa nigrocoerulea Smith.
Xylocopa fuliginata Pérez.
Xylocopa mimetica Cockerell.*
Mesotrichia amauroptera (Pérez).*
Mesotrichia sulcifrons (Pérez).*
Mesotrichia vachali (Pérez).*
Mesotrichia latipes basiloptera Cockerell.*
Trigona palavanica Cockerell.*
Trigona luteiventris Friese.
Apis florea rufiventris Friese.

Thus Palawan has twenty-six recorded species, about half not known elsewhere. Only three of these species are in the Sandakan list, and two of these occur elsewhere in the Philippines. The third, *Apis florea,* is represented by a distinct variety. *Dianthidium,* a genus found at Sandakan, is recorded in the Philippines only from Palawan. Palawan has two species of *Trigona,* while only a single species is known from elsewhere in the Philippines. Although these lists are very incomplete, it is evident that the bee fauna of Palawan is not closely related to that of Sandakan. About a quarter of the Sandakan species are known from the Philippines, excluding Palawan. About a third of the Palawan species are known from other Philippine Islands, but it is possible that some of these, nesting in wood or stems of plants, may have been accidentally introduced by man. The present indications are, then, that the bee fauna of Palawan is largely endemic, and has more resemblance to that of the other Philippine Islands than to that of North Borneo.

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